Section Life Cycle Management

Product Design and Development

Integrating Environmental Aspects into Product Design and Development

The new ISO TR 14062*

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Introduction

The new ISO TR 14 062 is a guide on how to integrate environmental aspects into product design and development. Strategic and business thinking is necessary for its application:

First of all, integration has to be performed on the existing company specific framework of management and product development. Secondly, ISO TR 14062 covers, in particular, the addition of environmental aspects and tools for the framework. However, many other influences, like social acceptance or competition, have also to be taken into consideration. Thirdly, product systems are often very complex and interlinked. Tools for the description of such complex systems exist, but for a design and development engineer, there is a missing link to the level of his needs for detailing his product.

Integration into existing company specific frameworks

Today, most companies have management systems or at least organization charts and product development schemes. ISO 14001 (environmental management system) is traditionally focused on product production. ISO 9001 (quality management system) is usually integrating all relevant aspects from product development until the product is supplied to the customer. Many companies include both systems in *one handbook*. ISO TR 14062 describes the processes, tools, modifications, and the reviews that can easily be transferred to each of the existing management systems:

This includes changes of existing management processes (e.g. from purchasing to an environmental supply chain management process) or the establishment of new processes like the take back process, analysis and environmental evaluation, documentation of environmental information, a Life Cycle Stakeholder Involvement approach (Schmidt 2002), etc. Most of these processes are missing, completely or partly, in both aforementioned management systems and have to be described individually. Customer satisfaction and environmental improvements have also to be brought together. This integration of management systems should be reflected by the integration of tools (see box).

A Failure Mode Effect Analysis (Design-FMEA) is a well established quality tool to identify potential failures in achieving the targeted functions of a new design. Systematically, the following steps are conducted:

- Potential classes of failures to achieve the targeted function are checked,
- Effects of the failure are described and weighted for 'severity',
- Root causes of the failures are identified and assessed regarding their 'occurrence',
- Existing detection methods and to their ability to detect the failure before an effect can take place.
- Measures to reduce the most important identified risks are agreed and a review of the improved situation is done.

In companies where FMEAs are applied to the development of all new products an Environment-FMEA (Ford 2001) is the natural fit of environmental tools as it is identical to classical FMEAS with the following differences:

- Not failures to achieve technical functions, but failures to achieve environmental objectives are checked
- The definition of the severity (and detection likelihood) is tailored to environmental effects.
- The designer is encouraged to look at the life cycle to avoid a problem shifting.

The Environment-FMEA shall be done together with Design-FMEAs. Consequently, the applied quality and environmental tools are merged – following the integration of environmental considerations in one management system.

Design rules and complexity of product systems and interlinks

Products are applied in systems that are complex and cannot be described completely, by the tools available at the moment (including LCA), as interlinks to other product systems occur and social or competitive reactions have to be considered. For example by e-business the numbers of transports are very much increased or by e-governance the behaviour of people could change dramatically because of lack of social contacts. The opportunities of a manufacturer who will be able to investigate such complex systems and gets more detailed experience in environmental improvements can be very high. Based on derived business strategies (e.g. selling service instead of product or increasing performance without increasing environmental impacts) simple environ-

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Table 1: Example for the application of design rules and their consequences over the whole life cycle

Life cycle phase	*Activities*	**Result for the Siemens Mobile Phone Base Station BS 241**
Marketing, Planning, Conceptual and Detailed Design	Integrate expectations of customers; estimate impact over life cycle; derive development targets	A new cooling (–33% cost) system avoiding an active cooling by air and new patent cooling with membrane filter (= no heat exchanger)
Procurement, Production**	Reduce material Reduce weight	New subrack: 1 part/1 material, ca. –80% cost; former rack: 66 parts, 4 materials
*Sales and Service **	Information about disposal Documentation for customers	Service call by software and remote control (= less service costs)
*Use/ application**	Information about long useful life and product use in environmental favorable way	Power consumption reduced by –35%, sensitivity increased by +2dB (corresponding power reduction in cellular phones –37%)
Disassembly, Disposal**	Ease of disassembly	Total product: Nearly 100% recycling possible

* Planning happens during 'planning and development' phase

mental design rules have to be deduced including as many opportunities as possible (see example for rules of Siemens standard SN 36 350 part 1).

Conclusion

It is recommended to transfer the general standard to the company-specific management systems, tools and cultures. Practical experience is necessary to identify its limits in each case. The future development of this Technical Report to a management system standard may not be difficult – and even necessary as shown in the paper. The problem occurs in the variety of opportunities to be implemented. Again, the integration shall be tailored to the existing management systems, in particular ISO 9001/14001. In addition, the design engineer needs the freedom of choice. Therefore a solution for this difficulty is necessary before starting a new standardization step. As this Technical Report is the first global one, the feedback from applicants in the different regions of the world will be interesting. The EHS Gate Section for DfE serves as the necessary exchange platform for this feedback.

Literature

Ford Design Institute (2001): FMEA training manual. Dearborn
ISO TR 14062 (2002): Environmental management – Integrating environmental aspects into product design and development
Schmidt W-P (2002): Strategies for Environmentally Sustainable Products and Services. In: Corporate Environmental Strategy, Vol 8, No 2, p 118–125
Siemens Standard SN 36350, part 1: Environmentally compatible product design

Book Presentations

Municipal Solid Waste Management Strategies and Technologies for Sustainable Solutions

Eds.: Christian Ludwig, Stefanie Hellweg, Samuel Stucki
Publisher: Springer-Verlag Berlin Heidelberg New York (http://www.springer.de) 2003; XX, 534 pp., 163 illus. Hardcover. 3-540-44100-X. Recommended Retail Price: EUR 129.00

Reference work, written for: Libraries, researchers and scientists (geochemistry, environmental science, process wengineering, technology, economy).

The environmental impact of traditional waste management practice has become a central concern in industrialized countries. The past decades have seen a dramatic development in the technology for reducing air pollution caused by incineration as stipulated by clean air policies in industrialized countries. Toxic and/or valuable and rare elements are still dispersed into the environment under current practice for the disposal of treated or untreated waste materials. This book results from the discussion among scientists, engineers and authorities; and hopes to contribute towards the implementation of future sustainable waste management practices.

Please note chapter 6 'Ecology: Which Technologies Perform Best?' written by Stefanie Hellweg, Gabor Doka, Goeran Finnveden and Konrad Hungerbühler. It includes an introduction to LCA, an LCA case study on waste treatment processes, and a discussion on long-term versus short-term impacts.

Electrical and Electronic Practical Ecodesing Guide

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Preface (by Jacqueline Aloisi de Larderel, UNEP and Laurent Grisel, PriceWaterhouseCoopers): This Electrical and Electronic Practical Eco-design Guide provides an insight into how the Electronics Industry can develop environmentally sustainable products. Evaluating the opportunities, risks, and trade-offs associated with products over their entire life cycle is now a fundamental element of company strategies on the road to sustainable development. This corresponds to the 'UN Guidelines for Consumer Protection' which were revised and adopted by governments at the UN General Assembly in 1999. The UN Guidelines call on governments, together with industry, to take into account the environmental impacts of products throughout their entire life cycle, in order to improve their environmental performance and respond to the demands of consumers.
This Eco-design Guide is also an important input into the development of cleaner and more resource efficient technologies for a life-cycle economy, as stated on 31 May 2000, in the 'Malmö Declaration' agreed upon by Ministers of the Environment. The Electrical and Electronic Practical Eco-design Guide is a practical application for the Electrical and Electronic Industry and an exiting follow-up of the UNEP publication 'Eco-design – A Promising Approach to Sustainable Production and Consumption'.